West Emergency Holding Pond
Liner Design Certification (2025 Retrofit)

Laramie River Station

Prepared for
Basin Electric Power Cooperative

Prepared by
Barr Engineering Co.

June 2025

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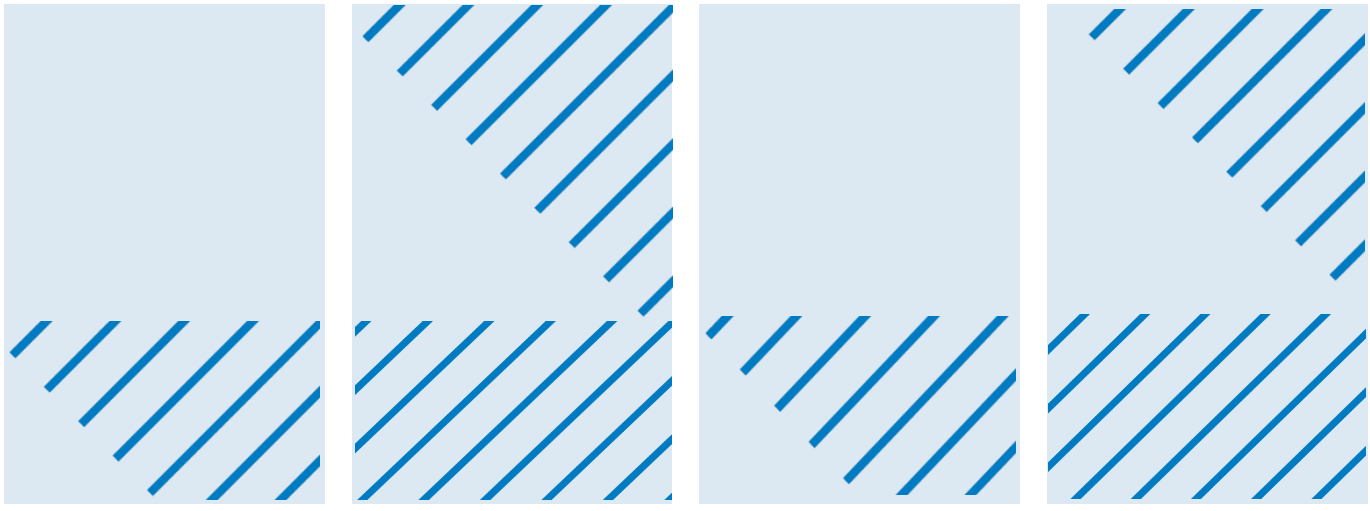
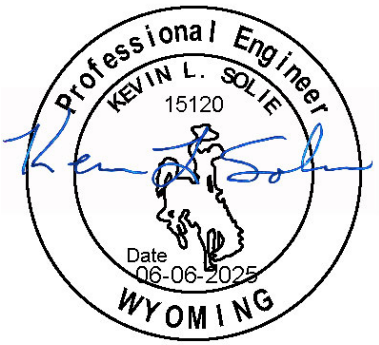


Certification

I hereby certify that I, or my agent, have examined the facility plans and specifications, and, being familiar with the provisions of 40 CFR 257 Subpart D and Wyoming Department of Environmental Quality rules attest that this Coal Combustion Residuals alternative composite liner design for the referenced CCR Unit design dated May 30, 2025 is in accordance with good engineering practice, including consideration of applicable industry standards and the requirements of 40 CFR §§ 257.70 and 257.72.



Kevin L. Solie
Wyoming PE #: 15120

June 6, 2025
Date

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1 Introduction

Laramie River Station (LRS) is a coal-fired power plant consisting of three units. The power plant, owned Missouri Basin Power Pool (MBPP) and operated by Basin Electric Power Cooperative (BEPC), is located at 347 Grayrocks Road, northeast of Wheatland in Platte County, Wyoming. Coal Combustion Residuals (CCRs) generated at LRS include bottom ash, flue gas desulfurization (FGD) materials and fly ash. CCR management is subject to Federal Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments per 40 Code of Federal Regulations (CFR) 257 Subpart D (CCR Rule). This LRS West Emergency Holding Pond (WEHP) project is also regulated by the Wyoming Department of Environmental Quality (WYDEQ) under permit 2025-0025, the Wyoming State Engineer's Office under Permit #8120R and is subject to the CCR Rule.

The CCR Rule establishes liner design criteria to help prevent contaminants in CCR from leaching from the CCR unit and contaminating groundwater. New and retrofit CCR surface impoundments must be lined with a composite liner, which is a liner system consisting of two components – a geomembrane and a two-foot layer of compacted soil – installed in direct and uniform contact with one another. The final rule allows an owner or operator to construct a CCR unit with an alternative composite liner, provided the alternative composite liner performs no less effectively than the composite liner. The Basin Electric retrofit of the WEHP proposes the use of an alternative composite liner. Accordingly, this certification was developed to satisfy the requirements of 40 CFR § 257.72 (Liner design criteria for new CCR surface impoundments and any lateral expansion of a CCR surface impoundment) as they apply to BEPC's retrofit of the WEHP.

The proposed liner system consists of a geocomposite clay liner (GCL) overlain by a synthetic liner. A high-density polyethylene (HDPE) will be used for the synthetic component, and liner thickness will be 60-mil or greater. Construction Quality Assurance/Quality Control (QA/QC) methodologies consistent the industry guidelines will be utilized so that the WEHP liner is constructed to meet the requirements set forth in the CCR Rule. The proposed WEHP bottom liner design will also include a 6- to 12-inch-thick layer of bottom ash (or other granular drainage material) along with perforated piping drainage system placed above the synthetic liner system to facilitate future dewatering efforts.

2 Liner System Design

The WEHP alternative composite liner system is configured as follows (from the top down for each component):

- Base
  - Drainage layer
  - 60-mil HDPE geomembrane barrier layer
  - Geosynthetic Clay Liner (GCL)
  - Prepared Subgrade
- Side Slopes
  - 80-mil HDPE geomembrane barrier layer; and
  - Geosynthetic Clay Liner (GCL)
  - Prepared Subgrade

3 Liner System Performance

The liner system for the WEHP retrofit must meet the criteria for a new or lateral expansion of a CCR surface impoundment as provided for in § 257.72(a) through (e). Composite liner design criteria found at § 257.70 are embedded within § 257.72 and must also be addressed. Applicable design and performance criteria are discussed below.

> ***§ 257.72 (a) New CCR surface impoundments and lateral expansions of existing and new CCR surface impoundments must be designed, constructed, operated, and maintained with either a composite liner or an alternative composite liner that meets the requirements of § 257.70(b) or (c).***

As an alternative composite liner design is proposed for the WEHP retrofit, the requirements set forth in 40 CFR § 257.70(c)(1) through (3) apply and are addressed below:

> ***§ 257.70(c)(1) - An alternative composite liner must consist of two components; the upper component consisting of, at a minimum, a 30-mil GM, and a lower component, that is not a geomembrane, with a liquid flow rate no greater than the liquid flow rate of two feet of compacted soil with a hydraulic conductivity of no more than $1x10^{-7}$ cm/sec. GM components consisting of high density polyethylene (HDPE) must be at least 60-mil thick. If the lower component of the alternative liner is compacted soil, the GM must be installed in direct and uniform contact with the compacted soil.***

The WEHP alternative composite liner system includes a 60-mil or 80-mil HDPE geomembrane layer overlying a GCL. The geosynthetic liner components will be installed in direct and uniform contact with a prepared subgrade. The prepared subgrade will be moisture conditioned, compacted, and smooth rolled to ensure intimate contact with the GCL. Although not part of design, material and construction quality testing will be performed in accordance with the Construction Quality Assurance Plan for Laramie River Station CCR Units (2024) and documented in a construction documentation report.

> ***§ 257.70(c)(2) - The Owner or Operator must obtain certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority that the liquid flow rate through the lower component of the alternative composite liner is no greater than the liquid flow rate through two feet of compacted soil with a hydraulic conductivity of $1x10^{-7}$ cm/sec. The hydraulic conductivity of any alternative to the two feet of compacted soil must be determined using recognized and generally accepted methods. The liquid flow rate comparison must be made using Equation 1 of this section, which is derived from Darcy's Law for gravity flow through porous media.***

$$(Eq.\ 1) \quad \frac{Q}{A} = q = k\left(\frac{h}{t} + 1\right)$$

Hydraulic conductivity tests were performed in accordance with ASTM D6766 utilizing CETCO Resistex 300DN9 and SOLMAX CAR Plus 3 using samples of pond water (CCR leachate) from the facility. The results of the hydraulic conductivity tests were utilized to confirm the liquid flow rate through the GCL would be less than the liquid flow rate through two feet of compacted soil with a hydraulic conductivity no greater than 1×10^{-7} cm/sec. Accordingly, the GCL component of the WEHP alternative composite liner system meets the liquid flow rate requirements prescribed in the rule.

§ 257.70(c)(3) provides that the requirements set forth in 257.70(b)(1) through (4) be addressed:

> ***§ 257.70(c)(3) - The alternative composite liner system must meet the requirements specified in paragraphs (b)(1) through (4) of this section***
>
> ***The composite liner must be:***
>
> ***§ 257.70(b)(1) – Constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrogeologic forces), physical contact with the CCR or leachate to which they are exposed, climatic conditions, the stress of installation, and the stress of daily operation.***

Material manufacturers completed chemical compatibility testing using the GCL and samples of liquids (CCR leachate) from various impoundments at LRS. Hydraulic conductivity tests were performed in accordance with ASTM D6766 utilizing CETCO Resistex 300DN9 and SOLMAX CAR Plus 3 and samples of CCR leachate from the facility. The testing determined that both tested GCLs had appropriate chemical properties to prevent failure due to physical contact with the CCR or leachate to which it would be exposed to. The results of the chemical compatibility testing were also utilized to determine that the flow rate through the GCL would be less than the flow rate through two feet of compacted soil with a hydraulic conductivity no greater than 1×10^{-7} cm/sec.

> ***§ 257.70(b)(2) - Constructed of materials that provide appropriate shear resistance of the upper and lower component interface to prevent sliding of the upper component including on the slopes;***

The alternative composite liner system for the WEHP is designed to resist the potential shear forces which will be applied to it. The HDPE membrane will be installed in an exposed condition and there will be limited shear forces present. Interface friction of the alternative composite liner components was determined to be adequate.

> ***§ 257.70(b)(3) - Placed upon a foundation or base capable of providing support to the liner and resistance to pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression, or uplift; and***

The WEHP is a retrofit of an existing CCR surface impoundment that has been in service for more than 35 years and has shown no signs of settlement, compression, or uplift. The alternative composite liner will be constructed on a prepared soil subgrade stable enough to support the liner system during construction as well as in the final installed and in-service configurations.

> ***§ 257.70(b)(4) - Installed to cover all the surrounding earth likely to be in contact with the CCR or leachate.***

The liner system and associated anchor trench for the WEHP have been designed to extend to the crest of the perimeter berms surrounding the CCR unit and completely cover the earth that may come in contact with the CCR. Further, the LRS surface impoundments are operated with in accordance applicable freeboard requirements (i.e., pond liquid levels are maintained at a safe level below the crest of the pond).

§ 257.72 (b) Any liner specified in this section must be installed to cover all surrounding earth likely to be in contact with CCR. Dikes shall not be constructed on top of the composite liner.

The liner system and associated anchor trench for the WEHP have been designed to extend to the crest of the perimeter berms surrounding the CCR unit and completely cover the earth that may come in contact with the CCR. No dikes will be constructed on top of the composite liner.

§ 257.72 (c) Prior to construction of the CCR surface impoundment or any lateral expansion of a CCR surface impoundment, the owner or operator must obtain certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority that the design of the composite liner or, if applicable, the design of an alternative composite liner complies with the requirements of this section.

This document serves as the qualified professional engineer (QPE) certification that the alternative composite liner complies with the requirements of § 257.72.

§ 257.72 (d) Upon completion, the owner or operator must obtain certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority that the composite liner or if applicable, the alternative composite liner has been constructed in accordance with the requirements of this section.

Once construction is complete, Basin Electric will obtain the requisite QPE certification.

§ 257.72 (e) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in § 257.105(f), the notification requirements specified in § 257.106(f), and the Internet requirements specified in § 257.107(f)

Recordkeeping requirements are addressed in section 5 of this document.

4 Summary and Conclusion

Based a review of the plans and specifications, the WEHP liner system meets the liner design criteria for a surface impoundment as provided for in § 257.72.

5 Recordkeeping and Reporting

Basin Electric will maintain a copy of the WEHP liner design certification in the facility's operating record in accordance with 40 CFR § 257.105 (Recordkeeping Requirements) and the plan will be made publicly available on the Basin Electric CCR web site in compliance with 40 CFR § 257.107 (Publicly Accessible Internet Site Requirements). Notification will be sent to the WYDEQ State Director in compliance with 40 CFR § 257.106 (Notification Requirements).